JAPANESE   [JP,2002-077280,A]

CLAIMS <u>DETAILED DESCRIPTION</u> <u>TECHNICAL FIELD</u> <u>PRIOR ART</u> <u>EFFECT OF THE</u>
<u>INVENTION</u> <u>TECHNICAL PROBLEM</u> <u>MEANS</u> <u>DESCRIPTION OF DRAWINGS</u> <u>DRAWINGS</u>

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] It is transmission data by which digital quadrature modulation was carried out to the predetermined carrier signal. The transmission data which hierarchized the same contents of information to the transmission data (low hierarchy transmission data) of a modulation technique with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency, and a coding method and transmission efficiency, and a coding method, and were transmitted A C/N detection means to detect the carrier power pair noise power ratio (C/N ratio) of an input signal in the receiving set to receive, It has a decode means to switch alternatively the Takashina layer transmission data and low hierarchy transmission data from the transmission data to which recovered transmission data from the input signal and it restored according to the above-mentioned C/N ratio, and to decode information. The above-mentioned decode means switches the transmission data decoded when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold to low hierarchy transmission data. The receiving set characterized by switching the transmission data decoded when having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above to the Takashina layer transmission data.
[Claim 2] The above-mentioned decode means is a receiving set according to claim 1 characterized by switching the transmission data to decode to the Takashina layer transmission data when having decoded low hierarchy transmission data and the period when the above-mentioned C/N ratio became more than the 2nd threshold carries out predetermined time continuation.
[Claim 3] The above-mentioned decode means is a receiving set according to claim 1 characterized by switching the transmission data to decode to low hierarchy transmission data when having decoded the Takashina layer transmission data and the period which became that the C/N ratio became below the 1st threshold carries out predetermined time continuation.
[Claim 4] When the 1st carries out period continuation, the period when the above-mentioned C/N ratio became more than the 2nd threshold when having decoded low hierarchy transmission data the above-mentioned decode means The transmission data to decode are switched to the Takashina layer transmission data. The receiving set according to claim 1 characterized by switching the transmission data decoded when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above which became that the C/N ratio became below the 1st threshold carries out period continuation to low hierarchy transmission data.

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the receiving set used for example, for BS
digital broadcasting etc.
[0002]
[Description of the Prior Art] In recent years, digital broadcasting, such as digital-communication
satellite broadcasting service (CS digital broadcasting), digital satellite broadcasting (BS), and
land-based digital broadcasting, is proposed as new broadcast media.
[0003] In such digital broadcasting, when a C/N (carrier power / noise power) ratio falls
according to causes, such as weather aggravation, the so-called block noise occurs, decode of
an image or a sound signal cannot be performed, but the problem that the output of an image or
a sound signal gets worse arises.
[0004] Especially, in Japan, the digital modulation method with the transmission efficiency high
as a modulation-code-ized method of TC8PSK (Trellis Coded 8 Phase Shift Keying) is adopted
by BS digital broadcasting of a broadcast initiation schedule in 2000. Therefore, for example, it
will be early influenced [of C/N] more by CS digital broadcasting which adopted QPSK
(Quadrature Phase Shift Keying) as a modulation-code-ized method of aggravation.
[0005] So, in BS digital broadcasting, the hierarchy modulation technique which hierarchizes and
transmits the same contents of information to two kinds of modulation-code-ized methods of
the Takashina layer transmission data with the high amount of transmissions and low hierarchy
transmission data with the low amount of transmissions as countermeasures of aggravation of
C/N by causes, such as weather aggravation, is adopted. In the case of BS digital broadcasting,
the transmission data modulated and encoded by TC8PSK are used as the Takashina layer
transmission data. Other than this (the transmission data with which BPSK (r=1/2) and QPSK
(r=1/2, 2/3, 3/4, 5/6, 7/8) were modulated and encoded are used as low hierarchy transmission
data) It has hierarchized (in addition, as for QPSK, the blowout CHADO coding method is
adopted, and, as for r, the rate of coding is shown.). .
[0006] At BS digital broadcasting, even if it sponsors the same program by adopting such a
hierarchy modulation technique, by the Takashina layer transmission data, the dynamic image
which the dynamic image and screen size which carried out coma dropping by the low hierarchy
image, for example became small by offering a HDTV image, for example, and carried out coma
dropping, the static image, the static image which carried out [voice] mute are offered. For this
reason, in BS digital broadcasting, even if a receive state worsens according to causes, such as
weather aggravation, and it becomes impossible to reproduce a HDTV image for example, a
viewer can be provided with minimum service of SDTV, a static image, etc.
[0007]
[Problem(s) to be Solved by the Invention] By the way, in the receiving set side of BS digital
broadcasting, such the Takashina layer transmission data and low hierarchy transmission data
will be switched according to a C/N ratio. For example, a certain fixed threshold will be defined,
it will judge whether a C/N ratio is more than this threshold or the following, the Takashina layer
and a low hierarchy will be switched, and information will be offered.

[0008] However, the weather is unstable, and when changing the value of a C/N ratio sharply for a short time, or when the C/N ratio has become near the threshold, the hierarchy's of the Takashina layer and a low hierarchy's change-over will arise frequently, for example. In such a case, a change-over with the usual television broadcasting and the television broadcasting to which for example, image contraction was carried out will arise frequently, and the displeasure and the troublesomeness by switch of a screen display will be given to a viewer.

[0009] This invention is made in view of such the actual condition, avoids the troublesomeness of viewing and listening by the hierarchy change-over produced frequently, and aims at offering the receiving set which can view and listen where a viewer is stabilized.

[0010]
[Means for Solving the Problem] The receiving set concerning this invention is transmission data by which digital quadrature modulation was carried out to the predetermined carrier signal. The transmission data which hierarchized the same contents of information to the transmission data (low hierarchy transmission data) of a modulation technique with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency, and a coding method and transmission efficiency, and a coding method, and were transmitted A C/N detection means to be the receiving set to receive and to detect the carrier power pair noise power ratio (C/N ratio) of an input signal, It has a decode means to switch alternatively the Takashina layer transmission data and low hierarchy transmission data from the transmission data to which recovered transmission data from the input signal and it restored according to the above-mentioned C/N ratio, and to decode information. The above-mentioned decode means switches the transmission data decoded when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold to low hierarchy transmission data. When having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, it is characterized by switching the transmission data to decode to the Takashina layer transmission data.

[0011] In this receiving set, in order to attain resistance to transmission degradation, or differentiation of information quality, for example, the transmission data (low hierarchy transmission data) of a modulation technique and a coding method with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency and a coding method and transmission efficiency are alternatively switched according to the C/N ratio of an input signal, and information is decoded. Under the present circumstances, a hysteresis is given to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list. With this receiving set, when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold, and switching the transmission data to decode to low hierarchy transmission data, having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, specifically, the transmission data to decode are switched to the Takashina layer transmission data.

[0012] Moreover, when the 1st carries out period continuation, the period when the above-mentioned C/N ratio became more than the 2nd threshold when having decoded low hierarchy transmission data the receiving set concerning this invention The transmission data to decode are switched to the Takashina layer transmission data, and when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above when the C/N ratio became below the 1st threshold carries out period continuation, the transmission data to decode are switched to low hierarchy transmission data.

[0013]
[Embodiment of the Invention] As a gestalt of operation of this invention, the receiving set of BS digital broadcasting which applied this invention is explained.

[0014] The block block diagram of the receiving set of BS digital broadcasting of the gestalt of operation of this invention is shown in drawing 1 .

[0015] It has the channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, the MPEG decoder 15, a control section 16, and the noise level pair C/N ratio table 17, and the receiving set 1 of BS digital broadcasting is constituted, as shown in drawing 1 .

[0016] The RF signal received by the parabolic antenna 2 is inputted into the channel selection section 11. The channel selection section 11 performs magnification, frequency conversion, filtering, etc., and outputs an IF signal. The outputted IF signal is supplied to the recovery section 12.

[0017] To an IF signal, the recovery section 12 performs a digital rectangular cross recovery, a DEPANKU tea ring, Viterbi decoding, a day interleave, reverse energy dispersal, RS decode, TS selection processing, etc., and outputs the transport stream (TS) in which the service whose viewer wishes to receive is included. This TS is a multiplexed signal specified with MPEG 2 systems. Moreover, as for this TS, data are packet-ized per 188 bytes of TS packet. TS outputted from the recovery section 12 is supplied to a descrambler 13.

[0018] A descrambler 13 performs descrambling processing to TS currently scrambled using the predetermined code key. TS to which descrambling processing was carried out is supplied to the TS decoder 14.

[0019] The TS decoder 14 performs filtering processing which extracts required TS packet (for example, TS packet for control the information of PSI and SI which are needed for TS packet in which the video information on a program that a viewer wishes to view and listen, audio information, and data information were included, playback of the program, etc. was described to be) with reference to PID (Packet Identification) of supplied TS packet. It separates into video, an audio, and data, respectively, and TS packet in which video information, audio information, and data information are included is supplied to the MPEG decoder 15 as a video elementary stream, an audio elementary stream, and a data elementary stream, respectively. Moreover, TS packet for control is supplied to a control section 16.

[0020] The MPEG decoder 15 performs elongation processing to the video elementary stream by which compression coding is carried out, an audio elementary stream, and a data elementary stream, and outputs the video signal of baseband, an audio signal, and a data signal.

[0021] A control section 16 performs control to the above-mentioned channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, and the MPEG decoder 15. Furthermore, a control section 16 performs switch control with the Takashina layer reception and low hierarchy reception based on the C/N ratio which computed and computed the C/N ratio based on the noise level detected by the recovery section 12.

[0022] The noise level pair C/N ratio table 17 is a table for computing the C/N ratio corresponding to the noise level from the noise level detected by the recovery section 12.

[0023] Next, the internal configuration of the above-mentioned recovery section 12 is explained by using drawing 2 .

[0024] As shown in drawing 2 , the recovery section 12 The noise level detecting element 21 and the BPSK recovery section 22, The QPSK (r=1/2) recovery section 23 and the QPSK (r=2/3) recovery section 24, It has the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, the TS8PSK recovery section 28, a multiplexer 29, the switch controller 30, and the transmission-line decode section 31, and is constituted.

[0025] The IF signal outputted from the channel selection section 11 is inputted into the noise level detecting element 21. The noise level detecting element 21 detects the level of the noise contained in the input signal from the inputted IF signal. The information on the detected noise level is supplied to a control section 16. The IF signal after the noise level was detected is supplied to the BPSK recovery section 22, the QPSK (r=1/2) recovery section 23, the QPSK (r=2/3) recovery section 24, the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, and the TS8PSK recovery section 28.

[0026] Here, in BS digital broadcasting, the modulation technique of BPSK, QPSK, and TC8PSK is switched dynamically, and is broadcast. Moreover, in QPSK, also in it, the rate of coding of a blowout chad sign is switched still more nearly dynamically, and is broadcast. By BS digital

broadcasting, it specifies that signal processing is performed per data configuration called a super frame, and, specifically, eight frames are dividing the super frame further. One frame consists of 48 more slots. At BS digital broadcasting, it is supposed in this slot unit that it is possible to change a modulation-code-ized method. Let this one slot be a data length equivalent to 1TS packet.

[0027] The BPSK recovery section 22, the QPSK (r=1/2) recovery section 23, the QPSK (r=2/3) recovery section 24, the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, and the TS8PSK recovery section 28 perform blowout tea ring processing, Viterbi decoding processing, etc. to the transmission data of a modulation-code-ized method which corresponded, respectively.

[0028] A multiplexer 29 follows the switch control by the switch controller 30. The recovery output of the BPSK recovery section 22, the QPSK (r=1/2) recovery section 23, the QPSK (r=2/3) recovery section 24, the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, and the TS8PSK recovery section 28 Dynamically, transmission data are chosen per slot with a switch, and the latter transmission-line decode section 31 is supplied. In addition, while the switch timing of a modulation-code-ized method takes a synchronization in synchronous code added to the so-called head of a super frame and carries out selection detection of the head of a slot, control of a switch location is performed with reference to the information described by TMCC (Transmission and Multiplexing ConfigurationControl).

[0029] The transmission-line decode section 31 performs day interleave processing, reverse energy diffusion process, and RS decode processing to the transmission data to which it restored according to each modulation-code-ized method. Furthermore, in the case of BS digital broadcasting, although transmission of a maximum of eight TS is enabled by one frequency channel, one TS chosen by the viewer etc. is outputted.

[0030] As mentioned above, the recovery section 12 detects the noise level of an input signal in them, and supplies it to them at a control section 16 while it performs transmission-line decode processing in recovery processing of BS digital broadcasting, and a list and reproduces TS in them.

[0031] Next, the internal configuration of the TS decoder 14 is explained by using drawing 3 .

[0032] It has the packet filter section 33 and the program selection section 34, and the TS decoder 14 is constituted, as shown in drawing 3 .

[0033] PID of TS packet which the TS decoder 14 extracts is specified from a control section 16, and processing which extracts required TS packet is performed with reference to this specified PID.

[0034] PID is the 13-bit information described in TS packet, and is the information for identifying the contents of information included in the TS packet. referring to PID -- for example, the packet in which video information is included for the TS packet, the packet in which audio information is included, and the packet in which data information is included -- or the TS packet can identify the packet in which PSI (Program Specific Information) and SI (Serves Information) are contained. furthermore, the packet in which the Takashina layer transmission data are contained for that TS packet by this PID -- or low hierarchy transmission data are contained -- it is discriminable a packet.

[0035] The program selection section 34 extracts only TS packet with which control the packet filter section 33 and specified PID is described to be based on the PID information specified from the control section 16, and supplies it to the MPEG decoder 15. Furthermore, TS packet specified among TS packets which PSI and SI are contained and are is extracted, and a control section 16 is supplied.

[0036] Moreover, PID to which the TS decoder 14 corresponds to the Takashina layer transmission data / low hierarchy transmission data is specified by the control section 16. When PID applicable to the Takashina layer transmission data is specified, the TS decoder 14 extracts TS packet in which the Takashina layer transmission data were contained, and sends out only TS packet by which the Takashina layer transmission data were contained in the latter MPEG decoder 15. Moreover, when PID applicable to low hierarchy transmission data is specified, the

TS decoder 14 extracts TS packet in which low hierarchy transmission data were contained, and sends out only TS packet by which low hierarchy transmission data were contained in the latter MPEG decoder 15. By performing such processing, the Takashina layer transmission data / low hierarchy transmission data can be switched.

[0037] Next, the contents [data / which are performed by the control section 16 / the Takashina layer transmission data and low hierarchy transmission data] of control of switch control are explained.

[0038] A control section 16 reads the noise level detected by the recovery section 12, and computes a C/N ratio with reference to the noise level pair C/N ratio table 17 based on the read noise level. On this noise level pair C/N ratio table 17, the correspondence relation between a noise level and a C/N ratio is beforehand described on the table. And a control section 16 switches whether the Takashina layer reception is performed or low hierarchy reception is performed based on the value of this computed C/N ratio.

[0039] Here, by preparing a hysteresis in the switch level of the C/N ratio which computed the switch with the Takashina layer reception and low hierarchy reception, and performing a time limit, in case a condition is switched further, the Takashina layer receive state and a low hierarchy receive state change complicated, and the control section 16 is controlling not to give a viewer displeasure.

[0040] Specifically in this control section 16, the switch level of a C/N ratio is set up as follows.

[0041] (1) Set the switch level of the C/N ratio to the low hierarchy reception from the Takashina layer reception as the 1st level Th 1. For example, if the 1st level was set up with 9dB, when a C/N ratio becomes the midst which is performing the Takashina layer reception with 9dB or less, it is switched to low hierarchy reception from the Takashina layer reception. In addition, this 1st level Th 1 is good to set it as the lowest possible value so that a viewer can be provided as much as possible with the information on the high quality by the Takashina layer transmission data. For example, it is set as C/N ratio extent which a block noise begins to generate.

[0042] (2) Set the switch level of the C/N ratio to the Takashina layer reception from low hierarchy reception as the 2nd level Th 2. Let this 2nd level Th 2 be a value higher than the 1st level Th 1 (Th2>Th1). For example, if the 2nd level was set up with 11dB, when a C/N ratio becomes the midst which is performing low hierarchy reception with 11dB or more, it is switched to the Takashina layer reception from low hierarchy reception. Usually, 2 or 3dB of C/N ratios is easily changed according to a weather condition. Therefore, it is desirable to prepare the margin more than this fluctuation range, and to set up the 2nd level Th 2 from the 1st level Th 1.

[0043] Thus, even when the C/N ratio of an input signal switches and it has become a value near the level by giving a hysteresis to switch level, a complicated screen switch etc. does not occur.

[0044] Furthermore, in this control section 16, the time limit at the time of switching a condition is set up as follows.

[0045] (3) During the 1st period Tm1, when a C/N ratio turns around the 2nd level Th 2 a top continuously, as for the change-over transition to the Takashina layer receive state from a low hierarchy receive state, it performs it. For example, if the 2nd level Th 2 was set up with 11dB and the 1st period Tm1 was set up with 10 seconds, when it changes into the condition that the C/N ratio has exceeded 11dB for 10 seconds or more to the midst which is performing low hierarchy reception, it is switched to the Takashina layer reception from low hierarchy reception.

[0046] (4) During the 2nd period Tm2, when a C/N ratio is continuously less than the 1st level Th 1, as for the change-over transition to a low hierarchy receive state from the Takashina layer receive state, it performs it. Here, the 2nd period Tm2 presupposes that it is a period shorter than the 1st period Tm1 (Tm2 <=Tm1). For example, if the 1st level Th 1 was set up with 9dB and the 2nd period Tm2 was set up with 0.5 seconds, when a C/N ratio changes into the condition that 9dB is in the Mashita time for 0.5 seconds or more at the midst which is performing low hierarchy reception, it is switched to low hierarchy reception from the Takashina layer reception.

[0047] In addition, when priority is given to not showing a viewer the condition that the effect by the block noise appears on a screen, as much as possible and a C/N ratio gets worse, the transition to a low hierarchy receive state from the Takashina layer receive state has set up the time limit short so that it may switch to a low hierarchy receive state immediately. On the contrary, it is made for a hierarchy change-over to also produce ******, and the transition to the Takashina layer receive state from a low hierarchy receive state has set up the time limit for a long time, when changing a C/N ratio with the big amplitude for example.

[0048] It explains to the next by showing the State machine which performs state control [receive state / the Takashina layer receive state and / low hierarchy] of a switch in drawing 4.

[0049] Control is performed in this State machine according to 4 of a condition S1 - a condition 4 conditions. A condition S1 and a condition S2 are the Takashina layer receive states. PID for extracting the Takashina layer transmission data in a condition S1 and a condition S2 will be supplied to the TS decoder 14 from a control section 16, and a viewer will be provided with the image data of the usual image size. On the other hand, a condition S3 and condition S4 are low hierarchy receive states. A viewer will be provided with the dynamic image which carried out coma dropping, the dynamic image which the screen size became small and carried out coma dropping, a static image, or the static image which carried out [voice] mute, although PID for extracting low hierarchy transmission data at the time of a condition S3 and condition S4 is supplied to the TS decoder 14 from a control section 16, for example, the contents of a program are the same as that of the Takashina layer received data.

[0050] First, this receiving set 1 will change in the condition S1, if reset, the reception initiation instruction of powering on or BS digital broadcasting, etc. are given.

[0051] A C/N ratio is judged in this condition S1. When a C/N ratio is larger than the 1st level Th 1, it stops at this condition S1, and when a C/N ratio is the 1st one or less level Th, it changes in the condition S2. Here, a counter timer is started to the timing which changes from a condition S1 to a condition S2.

[0052] In the condition S2, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 2nd period Tm2 and a C/N ratio is the 1st one or less level Th, it stops at this condition S2. Moreover, when [that the timer value time is smaller than the 2nd period Tm2 and] a C/N ratio is larger than the 1st level Th 1, it changes in the condition S1. Moreover, when the timer values time are the 2nd two or more periods Tm, it changes in the condition S3. A timer is reset from a condition S2 to the timing which changes from a condition S2 to a condition S1 and a condition S3.

[0053] A C/N ratio is judged in the condition S3. When a C/N ratio is smaller than the 2nd level Th 2, it stops at this condition S3, and when C/N ratios are the 2nd two or more level Th, it changes to condition S4. Here, a timer is started to the timing which changes from a condition S3 to condition S4.

[0054] In condition S4, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 1st period Tm1 and C/N ratios are the 2nd two or more level Th, it stops at this condition S4. Moreover, when [that the timer value time is smaller than the 1st period Tm1 and] a C/N ratio is smaller than the 2nd level Th 2, it changes in the condition S3. Moreover, when the timer values time are the 1st one or more periods Tm, it changes in the condition S1. A timer is reset from condition S4 to the timing which changes from condition S4 to a condition S3 and a condition S1.

[0055] He is trying to give a hysteresis to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list as mentioned above with the receiving set 1 of BS digital broadcasting of the gestalt of operation of this invention. Furthermore, even if a C/N ratio switches exceeding a threshold and fills conditions with this receiving set 1, a hierarchy change-over is not performed between fixed time amount, but after it is judged that the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch. Therefore, a switch with the Takashina layer transmission data and low hierarchy transmission data arises frequently, and things are lost. Therefore, giving

a viewer the displeasure and the troublesomeness by switch of a screen display is lost, and where a viewer is stabilized, it can view and listen.

[0056] As mentioned above, although the receiving set of BS digital broadcasting was explained as a gestalt of operation of this invention, this invention is not restricted to the receiving set of BS digital broadcasting, and if it is the receiving set of the broadcast which adopted the hierarchy modulation technique, it is applicable [this invention] to anythings.

[0057]

[Effect of the Invention] In the receiving set concerning this invention, in order to attain resistance to transmission degradation, or differentiation of information quality, for example, the transmission data (low hierarchy transmission data) of a modulation technique and a coding method with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency and a coding method and transmission efficiency are alternatively switched according to the C/N ratio of an input signal, and the contents of information are decoded. Under the present circumstances, a hysteresis is given to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list. With this receiving set, when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold, and switching the transmission data to decode to low hierarchy transmission data, having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, specifically, the transmission data to decode are switched to the Takashina layer transmission data.

[0058] moreover, when having decoded low hierarchy transmission data and the above-mentioned C/N ratio continues during the 1st period which became more than the 2nd threshold, the receiving set concerning this invention The transmission data to decode are switched to the Takashina layer transmission data, and when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above which became that the C/N ratio became below the 1st threshold carries out period continuation, the transmission data to decode are switched to low hierarchy transmission data. That is, once there is a hierarchy change-over, even if a C/N ratio switches exceeding a threshold and fulfills conditions, a hierarchy change-over is not performed between fixed time amount, but after it is judged that the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch.

[0059] In the receiving set applied to this invention by this, it is lost that a switch with the Takashina layer transmission data and low hierarchy transmission data arises frequently. Therefore, giving a viewer the displeasure and the troublesomeness by switch of a screen display is lost, and where a viewer is stabilized, it can view and listen.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the receiving set used for example, for BS digital broadcasting etc.

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art] In recent years, digital broadcasting, such as digital-communication satellite broadcasting service (CS digital broadcasting), digital satellite broadcasting (BS), and land-based digital broadcasting, is proposed as new broadcast media.

[0003] In such digital broadcasting, when a C/N (carrier power / noise power) ratio falls according to causes, such as weather aggravation, the so-called block noise occurs, decode of an image or a sound signal cannot be performed, but the problem that the output of an image or a sound signal gets worse arises.

[0004] Especially, in Japan, the digital modulation method with the transmission efficiency high as a modulation-code-ized method of TC8PSK (Trellis Coded 8 Phase Shift Keying) is adopted by BS digital broadcasting of a broadcast initiation schedule in 2000. Therefore, for example, it will be early influenced [of C/N] more by CS digital broadcasting which adopted QPSK (Quadrature Phase Shift Keying) as a modulation-code-ized method of aggravation.

[0005] So, in BS digital broadcasting, the hierarchy modulation technique which hierarchizes and transmits the same contents of information to two kinds of modulation-code-ized methods of the Takashina layer transmission data with the high amount of transmissions and low hierarchy transmission data with the low amount of transmissions as countermeasures of aggravation of C/N by causes, such as weather aggravation, is adopted. In the case of BS digital broadcasting, the transmission data modulated and encoded by TC8PSK are used as the Takashina layer transmission data. Other than this (the transmission data with which BPSK (r=1/2) and QPSK (r=1/2, 2/3, 3/4, 5/6, 7/8) were modulated and encoded are used as low hierarchy transmission data) It has hierarchized (in addition, as for QPSK, the blowout CHADO coding method is adopted, and, as for r, the rate of coding is shown.). .

[0006] At BS digital broadcasting, even if it sponsors the same program by adopting such a hierarchy modulation technique, by the Takashina layer transmission data, the dynamic image which the dynamic image and screen size which carried out coma dropping by the low hierarchy image, for example became small by offering a HDTV image, for example, and carried out coma dropping, the static image, the static image which carried out [voice] mute are offered. For this reason, in BS digital broadcasting, even if a receive state worsens according to causes, such as weather aggravation, and it becomes impossible to reproduce a HDTV image for example, a viewer can be provided with minimum service of SDTV, a static image, etc.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] In the receiving set concerning this invention, in order to attain
resistance to transmission degradation, or differentiation of information quality, for example, the
transmission data (low hierarchy transmission data) of a modulation technique and a coding
method with low transmission data (Takashina layer transmission data) of a modulation technique
with high transmission efficiency and a coding method and transmission efficiency are
alternatively switched according to the C/N ratio of an input signal, and the contents of
information are decoded. Under the present circumstances, a hysteresis is given to the threshold
of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the
Takashina layer transmission data to the switch to low hierarchy transmission data from the
Takashina layer transmission data, and a list. With this receiving set, when having decoded the
Takashina layer transmission data and a C/N ratio becomes below the 1st threshold, and
switching the transmission data to decode to low hierarchy transmission data, having decoded
low hierarchy transmission data and it becomes more than the 2nd threshold with the above-
mentioned C/N ratio higher than the 1st threshold of the above, specifically, the transmission
data to decode are switched to the Takashina layer transmission data.
[0058] moreover, when having decoded low hierarchy transmission data and the above-
mentioned C/N ratio continues during the 1st period which became more than the 2nd threshold,
the receiving set concerning this invention The transmission data to decode are switched to the
Takashina layer transmission data, and when having decoded the Takashina layer transmission
data and the 2nd with the period shorter than the 1st period of the above which became that the
C/N ratio became below the 1st threshold carries out period continuation, the transmission data
to decode are switched to low hierarchy transmission data. That is, once there is a hierarchy
change-over, even if a C/N ratio switches exceeding a threshold and fulfills conditions, a
hierarchy change-over is not performed between fixed time amount, but after it is judged that
the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch.
[0059] In the receiving set applied to this invention by this, it is lost that a switch with the
Takashina layer transmission data and low hierarchy transmission data arises frequently.
Therefore, giving a viewer the displeasure and the troublesomeness by switch of a screen display
is lost, and where a viewer is stabilized, it can view and listen.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original
precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, in the receiving set side of BS digital
broadcasting, such the Takashina layer transmission data and low hierarchy transmission data
will be switched according to a C/N ratio. For example, a certain fixed threshold will be defined,
it will judge whether a C/N ratio is more than this threshold or the following, the Takashina layer
and a low hierarchy will be switched, and information will be offered.
[0008] However, the weather is unstable, and when changing the value of a C/N ratio sharply for
a short time, or when the C/N ratio has become near the threshold, the hierarchy's of the
Takashina layer and a low hierarchy's change-over will arise frequently, for example. In such a
case, a change-over with the usual television broadcasting and the television broadcasting to
which for example, image contraction was carried out will arise frequently, and the displeasure
and the troublesomeness by switch of a screen display will be given to a viewer.
[0009] This invention is made in view of such the actual condition, avoids the troublesomeness
of viewing and listening by the hierarchy change-over produced frequently, and aims at offering
the receiving set which can view and listen where a viewer is stabilized.

[Translation done.]

MEANS

[Means for Solving the Problem] The receiving set concerning this invention is transmission data
by which digital quadrature modulation was carried out to the predetermined carrier signal. The
transmission data which hierarchized the same contents of information to the transmission data
(low hierarchy transmission data) of a modulation technique with low transmission data
(Takashina layer transmission data) of a modulation technique with high transmission efficiency,
and a coding method and transmission efficiency, and a coding method, and were transmitted A
C/N detection means to be the receiving set to receive and to detect the carrier power pair
noise power ratio (C/N ratio) of an input signal, It has a decode means to switch alternatively
the Takashina layer transmission data and low hierarchy transmission data from the transmission
data to which recovered transmission data from the input signal and it restored according to the
above-mentioned C/N ratio, and to decode information. The above-mentioned decode means
switches the transmission data decoded when having decoded the Takashina layer transmission
data and a C/N ratio becomes below the 1st threshold to low hierarchy transmission data. When
having decoded low hierarchy transmission data and it becomes more than the 2nd threshold
with the above-mentioned C/N ratio higher than the 1st threshold of the above, it is
characterized by switching the transmission data to decode to the Takashina layer transmission
data.
[0011] In this receiving set, in order to attain resistance to transmission degradation, or
differentiation of information quality, for example, the transmission data (low hierarchy
transmission data) of a modulation technique and a coding method with low transmission data
(Takashina layer transmission data) of a modulation technique with high transmission efficiency
and a coding method and transmission efficiency are alternatively switched according to the C/N
ratio of an input signal, and information is decoded. Under the present circumstances, a
hysteresis is given to the threshold of the C/N ratio which sets the timing of the switch from
low hierarchy transmission data to the Takashina layer transmission data to the switch to low
hierarchy transmission data from the Takashina layer transmission data, and a list. With this
receiving set, when having decoded the Takashina layer transmission data and a C/N ratio
becomes below the 1st threshold, and switching the transmission data to decode to low
hierarchy transmission data, having decoded low hierarchy transmission data and it becomes
more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold
of the above, specifically, the transmission data to decode are switched to the Takashina layer
transmission data.
[0012] Moreover, when the 1st carries out period continuation, the period when the above-
mentioned C/N ratio became more than the 2nd threshold when having decoded low hierarchy
transmission data the receiving set concerning this invention The transmission data to decode
are switched to the Takashina layer transmission data, and when having decoded the Takashina
layer transmission data and the 2nd with the period shorter than the 1st period of the above
when the C/N ratio became below the 1st threshold carries out period continuation, the
transmission data to decode are switched to low hierarchy transmission data.
[0013]
[Embodiment of the Invention] As a gestalt of operation of this invention, the receiving set of BS

digital broadcasting which applied this invention is explained.

[0014] The block block diagram of the receiving set of BS digital broadcasting of the gestalt of operation of this invention is shown in drawing 1 .

[0015] It has the channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, the MPEG decoder 15, a control section 16, and the noise level pair C/N ratio table 17, and the receiving set 1 of BS digital broadcasting is constituted, as shown in drawing 1 .

[0016] The RF signal received by the parabolic antenna 2 is inputted into the channel selection section 11. The channel selection section 11 performs magnification, frequency conversion, filtering, etc., and outputs an IF signal. The outputted IF signal is supplied to the recovery section 12.

[0017] To an IF signal, the recovery section 12 performs a digital rectangular cross recovery, a DEPANKU tea ring, Viterbi decoding, a day interleave, reverse energy dispersal, RS decode, TS selection processing, etc., and outputs the transport stream (TS) in which the service whose viewer wishes to receive is included. This TS is a multiplexed signal specified with MPEG 2 systems. Moreover, as for this TS, data are packet-ized per 188 bytes of TS packet. TS outputted from the recovery section 12 is supplied to a descrambler 13.

[0018] A descrambler 13 performs descrambling processing to TS currently scrambled using the predetermined code key. TS to which descrambling processing was carried out is supplied to the TS decoder 14.

[0019] The TS decoder 14 performs filtering processing which extracts required TS packet (for example, TS packet for control the information of PSI and SI which are needed for TS packet in which the video information on a program that a viewer wishes to view and listen, audio information, and data information were included, playback of the program, etc. was described to be) with reference to PID (Packet Identification) of supplied TS packet. It separates into video, an audio, and data, respectively, and TS packet in which video information, audio information, and data information are included is supplied to the MPEG decoder 15 as a video elementary stream, an audio elementary stream, and a data elementary stream, respectively. Moreover, TS packet for control is supplied to a control section 16.

[0020] The MPEG decoder 15 performs elongation processing to the video elementary stream by which compression coding is carried out, an audio elementary stream, and a data elementary stream, and outputs the video signal of baseband, an audio signal, and a data signal.

[0021] A control section 16 performs control to the above-mentioned channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, and the MPEG decoder 15. Furthermore, a control section 16 performs switch control with the Takashina layer reception and low hierarchy reception based on the C/N ratio which computed and computed the C/N ratio based on the noise level detected by the recovery section 12.

[0022] The noise level pair C/N ratio table 17 is a table for computing the C/N ratio corresponding to the noise level from the noise level detected by the recovery section 12.

[0023] Next, the internal configuration of the above-mentioned recovery section 12 is explained by using drawing 2 .

[0024] As shown in drawing 2 , the recovery section 12 The noise level detecting element 21 and the BPSK recovery section 22, The QPSK (r=1/2) recovery section 23 and the QPSK (r=2/3) recovery section 24, It has the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, the TS8PSK recovery section 28, a multiplexer 29, the switch controller 30, and the transmission-line decode section 31, and is constituted.

[0025] The IF signal outputted from the channel selection section 11 is inputted into the noise level detecting element 21. The noise level detecting element 21 detects the level of the noise contained in the input signal from the inputted IF signal. The information on the detected noise level is supplied to a control section 16. The IF signal after the noise level was detected is supplied to the BPSK recovery section 22, the QPSK (r=1/2) recovery section 23, the QPSK (r=2/3) recovery section 24, the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, and the TS8PSK recovery section 28.

[0026] Here, in BS digital broadcasting, the modulation technique of BPSK, QPSK, and TC8PSK is switched dynamically, and is broadcast. Moreover, in QPSK, also in it, the rate of coding of a blowout chad sign is switched still more nearly dynamically, and is broadcast. By BS digital broadcasting, it specifies that signal processing is performed per data configuration called a super frame, and, specifically, eight frames are dividing the super frame further. One frame consists of 48 more slots. At BS digital broadcasting, it is supposed in this slot unit that it is possible to change a modulation-code-ized method. Let this one slot be a data length equivalent to 1TS packet.

[0027] The BPSK recovery section 22, the QPSK (r=1/2) recovery section 23, the QPSK (r=2/3) recovery section 24, the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, and the TS8PSK recovery section 28 perform blowout tea ring processing, Viterbi decoding processing, etc. to the transmission data of a modulation-code-ized method which corresponded, respectively.

[0028] A multiplexer 29 follows the switch control by the switch controller 30. The recovery output of the BPSK recovery section 22, the QPSK (r=1/2) recovery section 23, the QPSK (r=2/3) recovery section 24, the QPSK (r=3/4) recovery section 25, the QPSK (r=5/6) recovery section 26, the QPSK (r=7/8) recovery section 27, and the TS8PSK recovery section 28 Dynamically, transmission data are chosen per slot with a switch, and the latter transmission-line decode section 31 is supplied. In addition, while the switch timing of a modulation-code-ized method takes a synchronization in synchronous code added to the so-called head of a super frame and carries out selection detection of the head of a slot, control of a switch location is performed with reference to the information described by TMCC (Transmission and Multiplexing ConfigurationControl).

[0029] The transmission-line decode section 31 performs day interleave processing, reverse energy diffusion process, and RS decode processing to the transmission data to which it restored according to each modulation-code-ized method. Furthermore, in the case of BS digital broadcasting, although transmission of a maximum of eight TS is enabled by one frequency channel, one TS chosen by the viewer etc. is outputted.

[0030] As mentioned above, the recovery section 12 detects the noise level of an input signal in them, and supplies it to them at a control section 16 while it performs transmission-line decode processing in recovery processing of BS digital broadcasting, and a list and reproduces TS in them.

[0031] Next, the internal configuration of the TS decoder 14 is explained by using drawing 3 .

[0032] It has the packet filter section 33 and the program selection section 34, and the TS decoder 14 is constituted, as shown in drawing 3 .

[0033] PID of TS packet which the TS decoder 14 extracts is specified from a control section 16, and processing which extracts required TS packet is performed with reference to this specified PID.

[0034] PID is the 13-bit information described in TS packet, and is the information for identifying the contents of information included in the TS packet. referring to PID -- for example, the packet in which video information is included for the TS packet, the packet in which audio information is included, and the packet in which data information is included -- or the TS packet can identify the packet in which PSI (Program Specific Information) and SI (Serves Information) are contained. furthermore, the packet in which the Takashina layer transmission data are contained for that TS packet by this PID -- or low hierarchy transmission data are contained -- it is discriminable a packet.

[0035] The program selection section 34 extracts only TS packet with which control the packet filter section 33 and specified PID is described to be based on the PID information specified from the control section 16, and supplies it to the MPEG decoder 15. Furthermore, TS packet specified among TS packets which PSI and SI are contained and are is extracted, and a control section 16 is supplied.

[0036] Moreover, PID to which the TS decoder 14 corresponds to the Takashina layer transmission data / low hierarchy transmission data is specified by the control section 16. When PID applicable to the Takashina layer transmission data is specified, the TS decoder 14 extracts

TS packet in which the Takashina layer transmission data were contained, and sends out only TS packet by which the Takashina layer transmission data were contained in the latter MPEG decoder 15. Moreover, when PID applicable to low hierarchy transmission data is specified, the TS decoder 14 extracts TS packet in which low hierarchy transmission data were contained, and sends out only TS packet by which low hierarchy transmission data were contained in the latter MPEG decoder 15. By performing such processing, the Takashina layer transmission data / low hierarchy transmission data can be switched.

[0037] Next, the contents [data / which are performed by the control section 16 / the Takashina layer transmission data and low hierarchy transmission data] of control of switch control are explained.

[0038] A control section 16 reads the noise level detected by the recovery section 12, and computes a C/N ratio with reference to the noise level pair C/N ratio table 17 based on the read noise level. On this noise level pair C/N ratio table 17, the correspondence relation between a noise level and a C/N ratio is beforehand described on the table. And a control section 16 switches whether the Takashina layer reception is performed or low hierarchy reception is performed based on the value of this computed C/N ratio.

[0039] Here, by preparing a hysteresis in the switch level of the C/N ratio which computed the switch with the Takashina layer reception and low hierarchy reception, and performing a time limit, in case a condition is switched further, the Takashina layer receive state and a low hierarchy receive state change complicated, and the control section 16 is controlling not to give a viewer displeasure.

[0040] Specifically in this control section 16, the switch level of a C/N ratio is set up as follows.

[0041] (1) Set the switch level of the C/N ratio to the low hierarchy reception from the Takashina layer reception as the 1st level Th 1. For example, if the 1st level was set up with 9dB, when a C/N ratio becomes the midst which is performing the Takashina layer reception with 9dB or less, it is switched to low hierarchy reception from the Takashina layer reception. In addition, this 1st level Th 1 is good to set it as the lowest possible value so that a viewer can be provided as much as possible with the information on the high quality by the Takashina layer transmission data. For example, it is set as C/N ratio extent which a block noise begins to generate.

[0042] (2) Set the switch level of the C/N ratio to the Takashina layer reception from low hierarchy reception as the 2nd level Th 2. Let this 2nd level Th 2 be a value higher than the 1st level Th 1 (Th2>Th1). For example, if the 2nd level was set up with 11dB, when a C/N ratio becomes the midst which is performing low hierarchy reception with 11dB or more, it is switched to the Takashina layer reception from low hierarchy reception. Usually, 2 or 3dB of C/N ratios is easily changed according to a weather condition. Therefore, it is desirable to prepare the margin more than this fluctuation range, and to set up the 2nd level Th 2 from the 1st level Th 1.

[0043] Thus, even when the C/N ratio of an input signal switches and it has become a value near the level by giving a hysteresis to switch level, a complicated screen switch etc. does not occur.

[0044] Furthermore, in this control section 16, the time limit at the time of switching a condition is set up as follows.

[0045] (3) During the 1st period Tm1, when a C/N ratio turns around the 2nd level Th 2 a top continuously, as for the change-over transition to the Takashina layer receive state from a low hierarchy receive state, it performs it. For example, if the 2nd level Th 2 was set up with 11dB and the 1st period Tm1 was set up with 10 seconds, when it changes into the condition that the C/N ratio has exceeded 11dB for 10 seconds or more to the midst which is performing low hierarchy reception, it is switched to the Takashina layer reception from low hierarchy reception.

[0046] (4) During the 2nd period Tm2, when a C/N ratio is continuously less than the 1st level Th 1, as for the change-over transition to a low hierarchy receive state from the Takashina layer receive state, it performs it. Here, the 2nd period Tm2 presupposes that it is a period shorter than the 1st period Tm1 (Tm2 <=Tm1). For example, if the 1st level Th 1 was set up with 9dB and the 2nd period Tm2 was set up with 0.5 seconds, when a C/N ratio changes into the

condition that 9dB is in the Mashita time for 0.5 seconds or more at the midst which is performing low hierarchy reception, it is switched to low hierarchy reception from the Takashina layer reception.

[0047] In addition, when priority is given to not showing a viewer the condition that the effect by the block noise appears on a screen, as much as possible and a C/N ratio gets worse, the transition to a low hierarchy receive state from the Takashina layer receive state has set up the time limit short so that it may switch to a low hierarchy receive state immediately. On the contrary, it is made for a hierarchy change-over to also produce ******, and the transition to the Takashina layer receive state from a low hierarchy receive state has set up the time limit for a long time, when changing a C/N ratio with the big amplitude for example.

[0048] It explains to the next by showing the State machine which performs state control [receive state / the Takashina-layer receive state and / low hierarchy] of a switch in <u>drawing</u> 4 .

[0049] Control is performed in this State machine according to 4 of a condition S1 - a condition 4 conditions. A condition S1 and a condition S2 are the Takashina layer receive states. PID for extracting the Takashina layer transmission data in a condition S1 and a condition S2 will be supplied to the TS decoder 14 from a control section 16, and a viewer will be provided with the image data of the usual image size. On the other hand, a condition S3 and condition S4 are low hierarchy receive states. A viewer will be provided with the dynamic image which carried out coma dropping, the dynamic image which the screen size became small and carried out coma dropping, a static image, or the static image which carried out [voice] mute, although PID for extracting low hierarchy transmission data at the time of a condition S3 and condition S4 is supplied to the TS decoder 14 from a control section 16, for example, the contents of a program are the same as that of the Takashina layer received data.

[0050] First, this receiving set 1 will change in the condition S1, if reset, the reception initiation instruction of powering on or BS digital broadcasting, etc. are given.

[0051] A C/N ratio is judged in this condition S1. When a C/N ratio is larger than the 1st level Th 1, it stops at this condition S1, and when a C/N ratio is the 1st one or less level Th, it changes in the condition S2. Here, a counter timer is started to the timing which changes from a condition S1 to a condition S2.

[0052] In the condition S2, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 2nd period Tm2 and a C/N ratio is the 1st one or less level Th, it stops at this condition S2. Moreover, when [that the timer value time is smaller than the 2nd period Tm2 and] a C/N ratio is larger than the 1st level Th 1, it changes in the condition S1. Moreover, when the timer values time are the 2nd two or more periods Tm, it changes in the condition S3. A timer is reset from a condition S2 to the timing which changes from a condition S2 to a condition S1 and a condition S3.

[0053] A C/N ratio is judged in the condition S3. When a C/N ratio is smaller than the 2nd level Th 2, it stops at this condition S3, and when C/N ratios are the 2nd two or more level Th, it changes to condition S4. Here, a timer is started to the timing which changes from a condition S3 to condition S4.

[0054] In condition S4, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 1st period Tm1 and C/N ratios are the 2nd two or more level Th, it stops at this condition S4. Moreover, when [that the timer value time is smaller than the 1st period Tm1 and] a C/N ratio is smaller than the 2nd level Th 2, it changes in the condition S3. Moreover, when the timer values time are the 1st one or more periods Tm, it changes in the condition S1. A timer is reset from condition S4 to the timing which changes from condition S4 to a condition S3 and a condition S1.

[0055] He is trying to give a hysteresis to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list as mentioned above with the receiving set 1 of BS digital broadcasting of the gestalt of operation of this invention. Furthermore, even if a C/N ratio switches exceeding a threshold and fills conditions with this receiving set 1, a hierarchy change-over is not performed between fixed

time amount, but after it is judged that the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch. Therefore, a switch with the Takashina layer transmission data and low hierarchy transmission data arises frequently, and things are lost. Therefore, giving a viewer the displeasure and the troublesomeness by switch of a screen display is lost, and where a viewer is stabilized, it can view and listen.

[0056] As mentioned above, although the receiving set of BS digital broadcasting was explained as a gestalt of operation of this invention, this invention is not restricted to the receiving set of BS digital broadcasting, and if it is the receiving set of the broadcast which adopted the hierarchy modulation technique, it is applicable [this invention] to anythings.

--[Translation done.]

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precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block block diagram of the receiving set of BS digital broadcasting which
applied this invention.
[Drawing 2] It is the block block diagram of the recovery section of the above-mentioned
receiving set.
[Drawing 3] It is the block block diagram of TS decoder of the above-mentioned receiving set.
[Drawing 4] It is drawing showing the State machine which performs state control [receive
state / the Takashina layer receive state and / low hierarchy] of a switch.
[Description of Notations]
1 BS Digital-Broadcasting Receiving Set, 2 Parabolic Antenna, 11 Channel Selection Section, 12
Recovery Sections, 13 Descrambler, 14 TS Decoder, 15 MPEG Decoder, 16 Control Section, 17
Noise Level Pair C/N Ratio Table, 21 Noise Level Detecting Element

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[Translation done.]

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7/081		7/08	Z	5C064
7/24		7/13	A	5K004

審査請求　未請求　請求項の数4　OL　（全 9 頁）　最終頁に続く

(54)【発明の名称】　受信装置

(57)【要約】

【課題】　BSデジタル放送で採用される階層変調方式を切り換える際に、頻繁に生じる階層切換による視聴の煩わしさを回避する。

【解決手段】　本発明のBSデジタル放送の受信装置1では、高階層伝送データと低階層伝送データとを、受信信号のC／N比に応じて選択的に切り換えて、情報内容の復号を行う。この際、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換えのタイミングを定めるC／N比のしきい値に、ヒステリシスを持たせる。

１
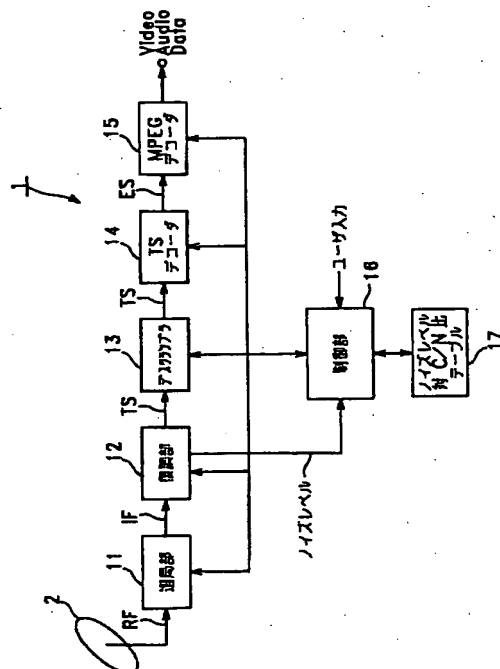
【特許請求の範囲】
【請求項１】　所定の搬送波信号に対してデジタル直交変調された伝送データであって、同一の情報内容を伝送効率の高い変調方式及び符号化方式の伝送データ（高階層伝送データ）と伝送効率の低い変調方式及び符号化方式の伝送データ（低階層伝送データ）とに階層化して伝送された伝送データを、受信する受信装置において、
受信信号の搬送波電力対ノイズ電力比（Ｃ／Ｎ比）を検出するＣ／Ｎ検出手段と、
受信信号から伝送データを復調し、上記Ｃ／Ｎ比に応じて復調された伝送データから高階層伝送データと低階層伝送データとを選択的に切り換えて情報の復号をする復号手段とを備え、
上記復号手段は、高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記Ｃ／Ｎ比が上記第１のしきい値より高い第２のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えることを特徴とする受信装置。
【請求項２】　上記復号手段は、低階層伝送データを復号している際に上記Ｃ／Ｎ比が第２のしきい値以上となった期間が所定時間連続したときに、復号する伝送データを高階層伝送データに切り換えることを特徴とする請求項１記載の受信装置。
【請求項３】　上記復号手段は、高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となったとなった期間が所定時間連続したときに、復号する伝送データを低階層伝送データに切り換えることを特徴とする請求項１記載の受信装置。
【請求項４】　上記復号手段は、低階層伝送データを復号している際に上記Ｃ／Ｎ比が第２のしきい値以上となった期間が第１の期間連続したときに、復号する伝送データを高階層伝送データに切り換え、
高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となったとなった期間が上記第１の期間より短い第２の期間連続したときには復号する伝送データを低階層伝送データに切り換えることを特徴とする請求項１記載の受信装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、例えばＢＳデジタル放送等に用いられる受信装置に関するものである。
【０００２】
【従来の技術】近年、デジタル通信衛星放送（ＣＳデジタル放送）、デジタル衛星放送（ＢＳ）、デジタル地上波放送等のデジタル放送が新たな放送メディアとして提案されている。
【０００３】このようなデジタル放送では、天候悪化などの原因によりＣ／Ｎ（搬送波電力／雑音電力）比が下

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がった場合、いわゆるブロックノイズが発生し、そのため画像や音声信号の復号ができず、画像や音声信号の出力が悪化するといった問題が生じる。
【０００４】特に、２０００年に日本において放送開始予定のＢＳデジタル放送では、変調符号化方式としてＴＣ８ＰＳＫ（Ｔｒｅｌｌｉｓ Ｃｏｄｅｄ ８ Ｐｈａｓｅ Ｓｈｉｆｔ Ｋｅｙｉｎｇ）といった伝送効率の高いデジタル変調方式を採用している。そのため、例えば、変調符号化方式としてＱＰＳＫ（Ｑｕａｄｒａｔｕｒｅ Ｐｈａｓｅ Ｓｈｉｆｔ Ｋｅｙｉｎｇ）を採用したＣＳデジタル放送等よりも、Ｃ／Ｎの悪化の影響をより早く受けることとなってしまう。
【０００５】そこで、ＢＳデジタル放送では、天候悪化等の原因によるＣ／Ｎの悪化の対応策として、同一の情報内容を、伝送量が高い高階層伝送データと、伝送量が低い低階層伝送データとの２通りの変調符号化方式に階層化して伝送する階層変調方式が採用されている。ＢＳデジタル放送の場合、ＴＣ８ＰＳＫで変調及び符号化された伝送データを高階層伝送データとし、それ以外（ＢＰＳＫ（ｒ＝1/2）,ＱＰＳＫ（ｒ＝1/2,2/3,3/4,5/6,7/8）の変調及び符号化された伝送データを低階層伝送データとして、階層化している（なお、ＱＰＳＫは、パンクチャード符号化方式が採用されており、ｒはその符号化率を示している。）。
【０００６】ＢＳデジタル放送では、このような階層変調方式を採用することにより、同じ番組を提供していても、高階層伝送データでは、例えばＨＤＴＶ画像を提供し、低階層画像では、例えばコマ落としをした動画像、画面サイズが小さくなり且つコマ落としをした動画像、静止画像、音声をミュートした静止画像等を提供している。このため、ＢＳデジタル放送では、例えば、天候悪化等の原因により受信状態が悪くなり、ＨＤＴＶ画像を再生することができなくなったとしても、ＳＤＴＶや静止画像等の最低限のサービスを視聴者に提供することができる。
【０００７】
【発明が解決しようとする課題】ところで、ＢＳデジタル放送の受信装置側では、このような高階層伝送データと低階層伝送データとを、Ｃ／Ｎ比に応じて切り換えることとなる。例えば、ある一定のしきい値を定め、Ｃ／Ｎ比がこのしきい値以上或いは以下であるかを判断し、高階層と低階層とを切り換えて情報を提供することとなる。
【０００８】しかしながら、例えば天候が不安定でＣ／Ｎ比の値が短時間で大幅に変動する場合、或いは、Ｃ／Ｎ比がしきい値近傍となっている場合には、高階層と低階層との階層の切換が頻繁に生じてしまう。このような場合、通常のテレビジョン放送と、例えば画像縮小がされたテレビジョン放送との切換が頻繁に生じてしまい、視聴者に例えば画面表示の切り換えによる不快感や煩わしさを与えてしまう。

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【０００９】本発明は、このような実情を鑑みてなされたものであり、頻繁に生じる階層切換による視聴の煩わしさを回避し、視聴者が安定した状態で視聴を行うことができる受信装置を提供することを目的とする。

【００１０】
【課題を解決するための手段】本発明にかかる受信装置は、所定の搬送波信号に対してデジタル直交変調された伝送データであって、同一の情報内容を伝送効率の高い変調方式及び符号化方式の伝送データ（高階層伝送データ）と伝送効率の低い変調方式及び符号化方式の伝送データ（低階層伝送データ）とに階層化して伝送された伝送データを、受信する受信装置であって、受信信号の搬送波電力対ノイズ電力比（Ｃ／Ｎ比）を検出するＣ／Ｎ検出手段と、受信信号から伝送データを復調し、上記Ｃ／Ｎ比に応じて復調された伝送データから高階層伝送データと低階層伝送データとを選択的に切り換えて情報の復号をする復号手段とを備え、上記復号手段は、高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記Ｃ／Ｎ比が上記第１のしきい値より高い第２のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えることを特徴とする。

【００１１】この受信装置では、例えば伝送劣化への耐性或いは情報品質の差別化等を図るため、伝送効率の高い変調方式及び符号化方式の伝送データ（高階層伝送データ）と伝送効率の低い変調方式及び符号化方式の伝送データ（低階層伝送データ）とを、受信信号のＣ／Ｎ比に応じて選択的に切り換えて、情報の復号を行う。この際、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換えのタイミングを定めるＣ／Ｎ比のしきい値に、ヒステリシスを持たせるようにする。具体的には、この受信装置では、高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記Ｃ／Ｎ比が上記第１のしきい値より高い第２のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えるようにする。

【００１２】また、本発明にかかる受信装置は、低階層伝送データを復号している際に上記Ｃ／Ｎ比が第２のしきい値以上となった期間が第１の期間連続したときに、復号する伝送データを高階層伝送データに切り換え、高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となった期間が上記第１の期間より短い第２の期間連続したときには復号する伝送データを低階層伝送データに切り換える。

【００１３】
【発明の実施の形態】本発明の実施の形態として、本発

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明を適用したＢＳデジタル放送の受信装置について説明をする。

【００１４】図１に、本発明の実施の形態のＢＳデジタル放送の受信装置のブロック構成図を示す。

【００１５】ＢＳデジタル放送の受信装置１は、図１に示すように、選局部１１と、復調部１２と、デスクランブラ１３と、ＴＳデコーダ１４と、ＭＰＥＧデコーダ１５と、制御部１６と、ノイズレベル対Ｃ／Ｎ比テーブル１７とを備えて構成される。

【００１６】選局部１１には、パラボラアンテナ２により受信されたＲＦ信号が入力される。選局部１１は、増幅、周波数変換、フィルタリング等を行い、ＩＦ信号を出力する。出力されたＩＦ信号は、復調部１２に供給される。

【００１７】復調部１２は、ＩＦ信号に対して、デジタル直交復調、デパンクチャリング、ビタビ復号、ディンタリーブ、逆エネルギー拡散、ＲＳ復号、ＴＳ選択処理等を行い、視聴者が受信を希望するサービスが含まれているトランスポートストリーム（ＴＳ）を出力する。このＴＳは、ＭＰＥＧ２システムズにより規定されている多重化信号である。また、このＴＳは、１８８バイトのＴＳパケット単位でデータがパケット化されている。復調部１２から出力されたＴＳは、デスクランブラ１３に供給される。

【００１８】デスクランブラ１３は、所定の暗号キーを用いてスクランブルされているＴＳに対して、デスクランブル処理を行う。デスクランブル処理がされたＴＳは、ＴＳデコーダ１４に供給される。

【００１９】ＴＳデコーダ１４は、供給されてきたＴＳパケットのＰＩＤ（Packet Identification）を参照して、必要なＴＳパケット（例えば視聴者が視聴を希望するプログラムのビデオ情報、オーディオ情報、データ情報が含まれたＴＳパケットや、そのプログラムの再生等に必要となるＰＳＩやＳＩといった情報が記述された制御用のＴＳパケット）を抽出するフィルタリング処理を行う。ビデオ情報、オーディオ情報、データ情報が含まれているＴＳパケットは、ビデオ、オーディオ、データにそれぞれ分離され、ビデオエレメンタリストリーム、オーディオエレメンタリストリーム、データエレメンタリストリームとして、それぞれＭＰＥＧデコーダ１５に供給される。また、制御用のＴＳパケットは、制御部１６に供給される。

【００２０】ＭＰＥＧデコーダ１５は、圧縮符号化されているビデオエレメンタリストリーム、オーディオエレメンタリストリーム、データエレメンタリストリームに対する伸張処理を行い、ベースバンドのビデオ信号、オーディオ信号、データ信号を出力する。

【００２１】制御部１６は、上記選局部１１、復調部１２、デスクランブラ１３、ＴＳデコーダ１４、ＭＰＥＧデコーダ１５に対する制御を行う。さらに、制御部１６

は、復調部１２により検出されたノイズレベルに基づき
Ｃ／Ｎ比を算出し、算出したＣ／Ｎ比に基づき高階層受
信と低階層受信との切り換え制御を行う。

【００２２】ノイズレベル対Ｃ／Ｎ比テーブル１７は、
復調部１２により検出されたノイズレベルから、そのノ
イズレベルに対応したＣ／Ｎ比を算出するためのテーブ
ルである。

【００２３】つぎに、上記復調部１２の内部構成につい
て図２を用いて説明をする。

【００２４】復調部１２は、図２に示すように、ノイズ
レベル検出部２１と、ＢＰＳＫ復調部２２と、ＱＰＳＫ
（r=1/2）復調部２３と、ＱＰＳＫ（r=2/3）復調部２４
と、ＱＰＳＫ（r=3/4）復調部２５と、ＱＰＳＫ（r=5/
6）復調部２６と、ＱＰＳＫ（r=7/8）復調部２７と、Ｔ
Ｓ８ＰＳＫ復調部２８と、マルチプレクサ２９と、切り
換えコントローラ３０と、伝送路復号部３１とを備えて
構成される。

【００２５】ノイズレベル検出部２１には、選局部１１
から出力されるＩＦ信号が入力される。ノイズレベル検
出部２１は、入力されたＩＦ信号から受信信号に含まれ
ているノイズのレベルを検出する。検出されたノイズレ
ベルの情報は、制御部１６に供給される。ノイズレベル
が検出された後のＩＦ信号は、ＢＰＳＫ復調部２２、Ｑ
ＰＳＫ（r=1/2）復調部２３、ＱＰＳＫ（r=2/3）復調部
２４、ＱＰＳＫ（r=3/4）復調部２５、ＱＰＳＫ（r=5/
6）復調部２６、ＱＰＳＫ（r=7/8）復調部２７、ＴＳ８
ＰＳＫ復調部２８に供給される。

【００２６】ここで、ＢＳデジタル放送では、ＢＰＳ
Ｋ、ＱＰＳＫ、ＴＣ８ＰＳＫの変調方式が、動的に切り
換えられて放送される。また、ＱＰＳＫでは、その中で
もパンクチャド符号の符号化率がさらに動的に切り換え
られて放送される。具体的には、ＢＳデジタル放送で
は、スーパーフレームと呼ばれるデータ構成単位で信号
処理が行われることを規定し、さらに、そのスーパーフ
レームを８個のフレームで分割している。１フレーム
は、さらに４８個のスロットで構成されている。ＢＳデ
ジタル放送では、このスロット単位で、変調符号化方式
を変更することが可能とされている。この１スロット
は、１ＴＳパケットに相当するデータ長とされている。

【００２７】ＢＰＳＫ復調部２２、ＱＰＳＫ（r=1/2）
復調部２３、ＱＰＳＫ（r=2/3）復調部２４、ＱＰＳＫ
（r=3/4）復調部２５、ＱＰＳＫ（r=5/6）復調部２６、
ＱＰＳＫ（r=7/8）復調部２７、ＴＳ８ＰＳＫ復調部２
８は、それぞれ対応した変調符号化方式の伝送データに
対するパンクチャリング処理、ビタビ復号処理等を行
う。

【００２８】マルチプレクサ２９は、切り換えコントロ
ーラ３０による切り換え制御に従い、ＢＰＳＫ復調部２
２、ＱＰＳＫ（r=1/2）復調部２３、ＱＰＳＫ（r=2/3）
復調部２４、ＱＰＳＫ（r=3/4）復調部２５、ＱＰＳＫ

（r=5/6）復調部２６、ＱＰＳＫ（r=7/8）復調部２７、
ＴＳ８ＰＳＫ復調部２８の復調出力を動的に切り換えな
がら伝送データを、スロット単位で選択して、後段の伝
送路復号部３１に供給する。なお、変調符号化方式の切
り換えタイミングは、いわゆるスーパーフレームの先頭
に付加されている同期コードにより同期をとってスロッ
トの先頭を選択検出するとともに、ＴＭＣＣ（Transmis
sion and Multiplexing ConfigurationControl）に記述
されている情報を参照して、切り換え位置の制御が行わ
れる。

【００２９】伝送路復号部３１は、各変調符号化方式に
応じて復調された伝送データに対して、ディンタリーブ
処理、逆エネルギー拡散処理、ＲＳ復号処理を行う。さ
らに、ＢＳデジタル放送の場合には、１つの周波数チャ
ネルで最大８本のＴＳを伝送可能とされているが、その
うち、視聴者等により選択された１つのＴＳを出力す
る。

【００３０】以上のように復調部１２は、ＢＳデジタル
放送の復調処理、並びに、伝送路復号処理を行い、ＴＳ
を再生するとともに、受信信号のノイズレベルを検出し
て制御部１６に供給する。

【００３１】つぎに、ＴＳデコーダ１４の内部構成につ
いて図３を用いて説明をする。

【００３２】ＴＳデコーダ１４は、図３に示すように、
パケットフィルタ部３３と、プログラム選択部３４とを
備えて構成される。

【００３３】ＴＳデコーダ１４は、抽出するＴＳパケッ
トのＰＩＤが、制御部１６から指定され、この指定され
たＰＩＤを参照して、必要なＴＳパケットを抽出する処
理を行う。

【００３４】ＰＩＤは、ＴＳパケット内に記述された１
３ビットの情報で、そのＴＳパケットに含まれている情
報内容を識別するための情報である。ＰＩＤを参照する
ことによって、例えば、そのＴＳパケットがビデオ情報
が含まれているパケットか、オーディオ情報が含まれて
いるパケットか、データ情報が含まれているパケット
か、或いは、そのＴＳパケットがＰＳＩ（Program Spec
ific Information）やＳＩ（Serves Information）が含
まれているパケットか、といったことを識別することが
できる。また、さらに、このＰＩＤにより、そのＴＳパ
ケットが、高階層伝送データが含まれているパケット
か、或いは、低階層伝送データが含まれているパケット
かも識別することができる。

【００３５】プログラム選択部３４は、制御部１６から
指定されたＰＩＤ情報に基づき、パケットフィルタ部３
３を制御して、指定されたＰＩＤが記述されているＴＳ
パケットのみを抽出してＭＰＥＧデコーダ１５に供給す
る。また、さらに、ＰＳＩやＳＩが含まれいてるＴＳパ
ケットのうち、指定されたＴＳパケットを抽出して制御
部１６に供給する。

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【００３６】また、ＴＳデコーダ１４は、高階層伝送データ／低階層伝送データに該当するＰＩＤが、制御部１６により指定される。ＴＳデコーダ１４は、高階層伝送データに該当するＰＩＤが指定された場合には、高階層伝送データが含まれたＴＳパケットを抽出して、後段のＭＰＥＧデコーダ１５に高階層伝送データが含まれたＴＳパケットのみを送出する。また、ＴＳデコーダ１４は、低階層伝送データに該当するＰＩＤが指定された場合には、低階層伝送データが含まれたＴＳパケットを抽出して、後段のＭＰＥＧデコーダ１５に低階層伝送データが含まれたＴＳパケットのみを送出する。このような処理を行うことにより、高階層伝送データ／低階層伝送データの切り換えを行うことができる。

【００３７】つぎに、制御部１６により行われる高階層伝送データと低階層伝送データとの切り換え制御の制御内容について説明をする。

【００３８】制御部１６は、復調部１２により検出されたノイズレベルを読み出し、読み出したノイズレベルに基づきノイズレベル対Ｃ／Ｎ比テーブル１７を参照し、Ｃ／Ｎ比を算出する。このノイズレベル対Ｃ／Ｎ比テーブル１７には、予めノイズレベルとＣ／Ｎ比との対応関係をテーブル上に記述してある。そして、制御部１６は、この算出したＣ／Ｎ比の値に基づき、高階層受信を行うか、低階層受信を行うかの切り換えを行う。

【００３９】ここで、制御部１６は、高階層受信と低階層受信との切り換えを、算出したＣ／Ｎ比の切り換えレベルにヒステリシスを設け、さらに、状態を切り換える際に時間制限を行うことにより、高階層受信状態と低階層受信状態とが煩雑に切り替わり、視聴者に不快感を与えないように制御をしている。

【００４０】この制御部１６では、具体的には、Ｃ／Ｎ比の切り換えレベルを以下のように設定をしている。

【００４１】（１）　高階層受信から低階層受信へのＣ／Ｎ比の切り換えレベルを、第１のレベルＴｈ１に設定する。例えば、第１のレベルを９ｄＢと設定したとすれば、高階層受信を行っている最中にＣ／Ｎ比が９ｄＢ以下となったときには、高階層受信から低階層受信へ切り換えられる。なお、この第１のレベルＴｈ１は、できるだけ高階層伝送データによる高品質の情報を視聴者に提供できるように、可能な限り低い値に設定するとよい。例えば、ブロックノイズが発生し始めるＣ／Ｎ比程度に設定をする。

【００４２】（２）　低階層受信から高階層受信へのＣ／Ｎ比の切り換えレベルを、第２のレベルＴｈ２に設定する。この第２のレベルＴｈ２は、第１のレベルＴｈ１よりも高い値とする（Ｔｈ２＞Ｔｈ１）。例えば、第２のレベルを１１ｄＢと設定したとすれば、低階層受信を行っている最中にＣ／Ｎ比が１１ｄＢ以上となったときには、低階層受信から高階層受信へ切り換えられる。通常、Ｃ／Ｎ比は、天候状態によって２、３ｄＢは容易に

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変動する。そのため、第１のレベルＴｈ１から、この変動範囲以上のマージンを設けて、第２のレベルＴｈ２を設定することが望ましい。

【００４３】このように切り換えレベルにヒステリシスを持たせることにより、例えば、受信信号のＣ／Ｎ比が切り換えレベルの近傍の値となっている場合でも、煩雑な画面切り換え等が発生しない。

【００４４】また、さらに、この制御部１６では、状態を切り換える際の時間制限を以下のように設定をしている。

【００４５】（３）　低階層受信状態から高階層受信状態への切換遷移は、Ｃ／Ｎ比が第２のレベルＴｈ２を、第１の期間Ｔｍ１の間、連続して上まわったときに行う。例えば、第２のレベルＴｈ２を１１ｄＢと設定し、第１の期間Ｔｍ１を１０秒と設定したとすれば、低階層受信を行っている最中にＣ／Ｎ比が１１ｄＢを１０秒以上の間上回っている状態となったときには、低階層受信から高階層受信へ切り換えられる。

【００４６】（４）　高階層受信状態から低階層受信状態への切換遷移は、Ｃ／Ｎ比が第１のレベルＴｈ１を、第２の期間Ｔｍ２の間、連続して下回ったときに行う。ここで、第２の期間Ｔｍ２は、第１の期間Ｔｍ１より短い期間であるとする（Ｔｍ２≦Ｔｍ１）。例えば、第１のレベルＴｈ１を９ｄＢと設定し、第２の期間Ｔｍ２を０．５秒と設定したとすれば、低階層受信を行っている最中にＣ／Ｎ比が９ｄＢを０．５秒以上の間下回っている状態となったときには、高階層受信から低階層受信へ切り換えられる。

【００４７】なお、高階層受信状態から低階層受信状態への遷移は、ブロックノイズによる影響が画面に現れる状態をできるだけ視聴者に見せないことを優先して、Ｃ／Ｎ比が悪化した場合には、即座に低階層受信状態に切り換えるように、時間制限を短く設定している。反対に、低階層受信状態から高階層受信状態への遷移は、例えば、大きな振幅でＣ／Ｎ比が変動する場合などになんども階層切換が生じないようにし、時間制限を長く設定している。

【００４８】つぎに、高階層受信状態と低階層受信状態との切り換えの状態制御を行うステートマシーンを図４に示して説明を行う。

【００４９】このステートマシーンには、状態Ｓ１～状態４の４状態により制御が行われる。状態Ｓ１と状態Ｓ２は、高階層受信状態である。状態Ｓ１及び状態Ｓ２のときには、高階層伝送データを抽出するためのＰＩＤが制御部１６からＴＳデコーダ１４に供給され、通常の画像サイズの画像データが視聴者に提供されることとなる。一方、状態Ｓ３と状態Ｓ４は、低階層受信状態である。状態Ｓ３及び状態Ｓ４のときには、低階層伝送データを抽出するためのＰＩＤが制御部１６からＴＳデコーダ１４に供給され、例えば、番組内容は高階層受信デー

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タと同一であるが、コマ落としをした動画像、画面サイズが小さくなり且つコマ落としをした動画像、静止画像、或いは、音声をミュートした静止画像等が視聴者に提供されることとなる。

【００５０】まず、この受信装置１がリセットや電源投入、或いは、ＢＳデジタル放送の受信開始命令等が与えられると、状態Ｓ１に遷移する。

【００５１】この状態Ｓ１では、Ｃ／Ｎ比が判断される。Ｃ／Ｎ比が第１のレベルＴｈ１より大きい場合には、この状態Ｓ１で留まり、Ｃ／Ｎ比が第１のレベルＴｈ１以下である場合には、状態Ｓ２に遷移する。ここで、状態Ｓ１から状態Ｓ２へ遷移するタイミングで、カウンタタイマーが起動される。

【００５２】状態Ｓ２では、Ｃ／Ｎ比とともにタイマーによりカウントされたタイマー値ｔｉｍｅが判断される。タイマー値ｔｉｍｅが第２の期間Ｔｍ２より小さく且つＣ／Ｎ比が第１のレベルＴｈ１以下である場合には、この状態Ｓ２で留まる。また、タイマー値ｔｉｍｅが第２の期間Ｔｍ２より小さく且つＣ／Ｎ比が第１のレベルＴｈ１より大きい場合には、状態Ｓ１に遷移する。また、タイマー値ｔｉｍｅが第２の期間Ｔｍ２以上の場合には、状態Ｓ３に遷移する。状態Ｓ２から状態Ｓ１、状態Ｓ２から状態Ｓ３へ遷移するタイミングで、タイマーがリセットされる。

【００５３】状態Ｓ３では、Ｃ／Ｎ比が判断される。Ｃ／Ｎ比が第２のレベルＴｈ２より小さい場合には、この状態Ｓ３で留まり、Ｃ／Ｎ比が第２のレベルＴｈ２以上である場合には、状態Ｓ４に遷移する。ここで、状態Ｓ３から状態Ｓ４へ遷移するタイミングで、タイマーが起動される。

【００５４】状態Ｓ４では、Ｃ／Ｎ比とともにタイマーによりカウントされたタイマー値ｔｉｍｅが判断される。タイマー値ｔｉｍｅが第１の期間Ｔｍ１より小さく且つＣ／Ｎ比が第２のレベルＴｈ２以上である場合には、この状態Ｓ４で留まる。また、タイマー値ｔｉｍｅが第１の期間Ｔｍ１より小さく且つＣ／Ｎ比が第２のレベルＴｈ２より小さい場合には、状態Ｓ３に遷移する。また、タイマー値ｔｉｍｅが第１の期間Ｔｍ１以上の場合には、状態Ｓ１に遷移する。状態Ｓ４から状態Ｓ３、状態Ｓ４から状態Ｓ１へ遷移するタイミングで、タイマーがリセットされる。

【００５５】以上のように本発明の実施の形態のＢＳデジタル放送の受信装置１では、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換えのタイミングを定めるＣ／Ｎ比のしきい値に、ヒステリシスを持たせるようにしている。さらに、この受信装置１では、たとえＣ／Ｎ比がしきい値を越えて切り換え条件を満たしたとしても、一定時間の間は階層切換を行わず、確実にＣ／Ｎ比がしきい値を越えたと判断されてから階層切り換えを

行うようにしている。そのため、高階層伝送データと低階層伝送データとの切り換えが頻繁に生じことがなくなる。従って、視聴者に例えば画面表示の切り換えによる不快感や煩わしさを与えることがなくなり、視聴者が安定した状態で視聴を行うことができる。

【００５６】以上、本発明の実施の形態としてＢＳデジタル放送の受信装置について説明をしたが、本発明は、ＢＳデジタル放送の受信装置に限られるものではなく、階層変調方式を採用した放送の受信装置であればどのようなものにでも適用することができる。

【００５７】
【発明の効果】本発明にかかる受信装置では、例えば伝送劣化への耐性或いは情報品質の差別化等を図るため、伝送効率の高い変調方式及び符号化方式の伝送データ（高階層伝送データ）と伝送効率の低い変調方式及び符号化方式の伝送データ（低階層伝送データ）とを、受信信号のＣ／Ｎ比に応じて選択的に切り換えて、情報内容の復号を行う。この際、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換えのタイミングを定めるＣ／Ｎ比のしきい値に、ヒステリシスを持たせるようにする。具体的には、この受信装置では、高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記Ｃ／Ｎ比が上記第１のしきい値より高い第２のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えるようにする。

【００５８】また、本発明にかかる受信装置は、低階層伝送データを復号している際に上記Ｃ／Ｎ比が第２のしきい値以上となった第１の期間の間連続したときには、復号する伝送データを高階層伝送データに切り換え、高階層伝送データを復号している際にＣ／Ｎ比が第１のしきい値以下となったとなった期間が上記第１の期間より短い第２の期間連続したときには復号する伝送データを低階層伝送データに切り換える。すなわち、一旦階層切換があったのちには、たとえＣ／Ｎ比がしきい値を越えて切り換え条件を満たしたとしても、一定時間の間は階層切換を行わず、確実にＣ／Ｎ比がしきい値を越えたと判断されてから階層切り換えを行うようにする。

【００５９】このことにより本発明にかかる受信装置では、高階層伝送データと低階層伝送データとの切り換えが頻繁に生じることがなくなる。従って、視聴者に例えば画面表示の切り換えによる不快感や煩わしさを与えることがなくなり、視聴者が安定した状態で視聴を行うことができる。

【図面の簡単な説明】
【図１】本発明を適用したＢＳデジタル放送の受信装置のブロック構成図である。
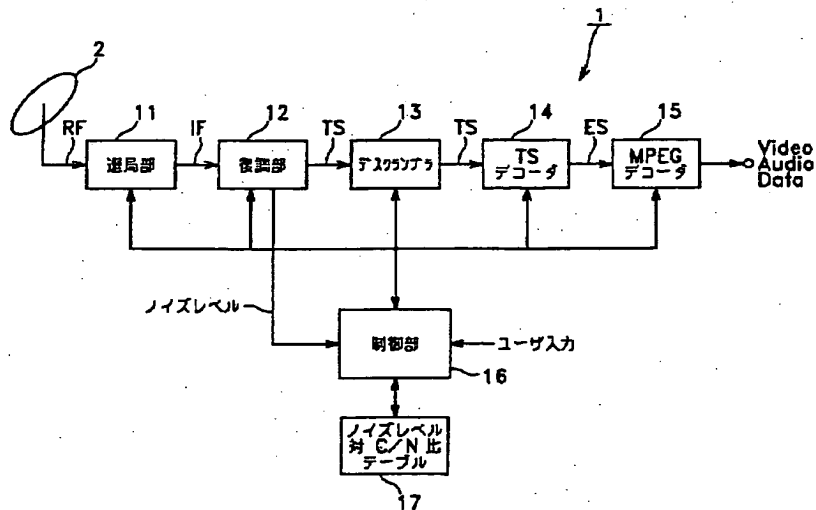【図２】上記受信装置の復調部のブロック構成図であ

る。
【図３】上記受信装置のＴＳデコーダのブロック構成図
である。
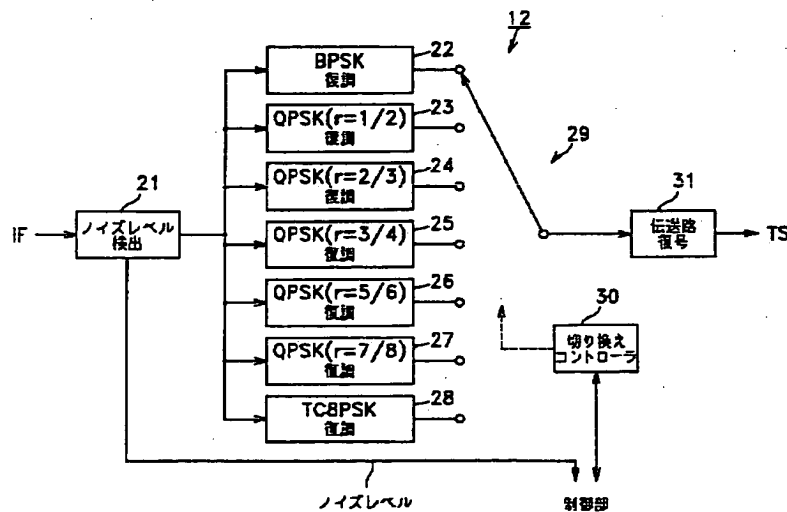【図４】高階層受信状態と低階層受信状態との切り換え
の状態制御を行うステートマシーンを示す図である。
【符号の説明】

＊１　ＢＳデジタル放送受信装置、２　パラボラアンテ
ナ、１１　選局部、１２復調部、１３　デスクランブ
ラ、１４　ＴＳデコーダ、１５　ＭＰＥＧデコーダ、１
６　制御部、１７　ノイズレベル対Ｃ／Ｎ比テーブル、
２１　ノイズレベル検出部

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【図１】

【図２】

【図3】

【図4】
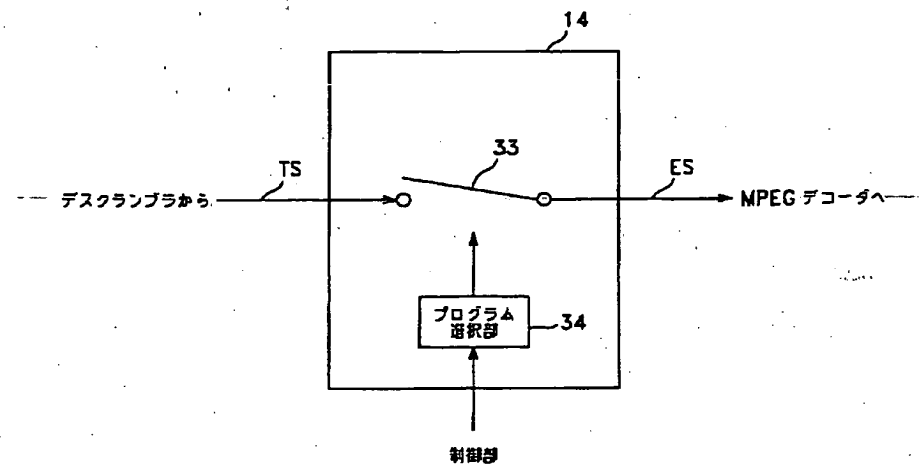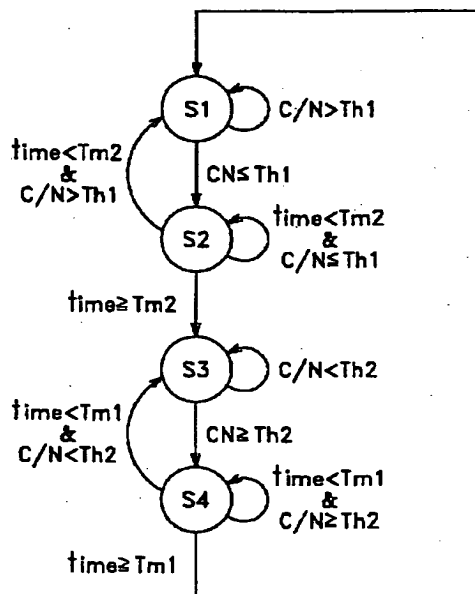
フロントページの続き

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　　　　　　　　　　　 SS02 TA06 TA07 TA36 TC21
　　　　　　　　　　　 TD05 TD12 UA02 UA05
　　　　　　　　5C063 AA01 AB03 AB07 AC01 CA12
　　　　　　　　　　　 CA23 CA31
　　　　　　　　5C064 BA07 BB05 BB07 BC17 BC22
　　　　　　　　　　　 BD07 BD08
　　　　　　　　5K004 AA05 FA03 FA05 FA07 FH00